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REPORT

CD NO.

50X1-HUM

COUNTRY	USSR	DATE OF INFORMATION	1949
SUBJECT	Medical - Endemic diseases		
HOW PUBLISHED	Irregular periodical	DATE DIST.	29 Mar 1950
WHERE PUBLISHED	Moscow/Leningrad	NO. OF PAGES	3
DATE PUBLISHED	1949		
LANGUAGE	Russian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

SOURCE Trudy Biogeokhimicheskoy Laboratorii, Vol IX, 1949.

CHEMICAL ANALYSIS OF FOOD AS A METHOD FOR ELIMINATING DEFORMATIVE ENDEMIA

This issue of Works of the Biogeochemical Laboratory contains several articles which attempt to present a new method of attacking deformative endemia (Urovskaya endemia) by conducting chemical analyses of drinking water and food. Three of the articles deal with the relation between the chemical composition of water and the etiology of deformative endemia in various parts of the USSR.

A. P. Vinogradov, whose article (1) presents the results of geochemical studies on the etiology of this disease, claims that a calcium deficiency in drinking water is the primary cause. Research was conducted in villages located in the eastern Transbaykal region in an area bordered by the Shilka River on the north, the Agrun' River on the east, and the Northern Borzya and Unda rivers on the west. In many of the villages and settlements examination of the inhabitants indicated positive disruption of the calcium-phosphorus balance and they were afflicted with irregular and abnormal development of the bones. Some data was collected to prove that a high strontium content accompanied by a low calcium content is generally the most common cause of deformation of the skeletal bones. However, no definite proof could be found.

In one village the inhabitants claimed that the deformation was the result of radioactive lead, cadmium, gold, potassium traces, and even radium content (spectroscopic examination revealed 10^{-13} percent) of the "sick" water, but intense investigations showed very slight, if any, traces of these substances. On the contrary, the results obtained by the author and his colleagues proved beyond all possible doubt that the claims of the inhabitants were absolutely without foundation. Spectroscopic studies of various water samples revealed traces of copper, zinc, lead, titanium, magnesium, molybdenum and other chemicals. It was concluded that these substances actually did not have much bearing on the etiology of deformative endemia. Nevertheless, it was agreed that further study should be conducted to determine the effect of molybdenum on this disease. Vinogradov states that this type of study is a relatively recent innovation that his findings are not conclusive, and that research is continuing to determine the effect of various organic substances on this deformative condition.

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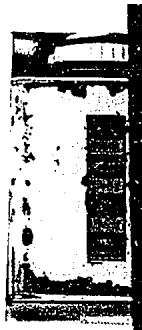

P. N. Paley (2) also describes the effect of the calcium content of drinking water on the etiology of this disease. The data in Paley's report is the result of work conducted by the Urova Institute of the Irkutsk Medical Institute, the Biogeochemical Laboratory of the Academy of Sciences USSR, and other institutions. In general, it can be stated that incidences of this disease are directly related to the type of water being used by the community.

A comprehensive table notes the sites where the water samples were obtained, percentage of adults in the second and third degrees of this disease, percentage of general infection, date of observations, calcium content in milligrams per hundred grams (10^{-3} percent), and the source of the data. The expeditions which collected data worked primarily in the permafrost zone east of the Shilka River in the Nerchinskiy Mountain Range region. Specific tests were conducted to determine the pH value of the water and the morbidity rate, but results were negative. However, the data did confirm the hypothesis presented by Vinogradov in 1936, that a lack of calcium in the water or in the diet is the determining factor in the etiology of deformative endemia.

V. S. Malinina (3) elaborates on Paley's theme and reports the results of studies she conducted to determine the chemical content of foodstuffs in regions where this deformative disease is prevalent. Malinina does not attempt to discredit the accepted theory that this disease is caused primarily by a lack of calcium in drinking water, but adds that no less important is the possiblity of low calcium content of diets. Specific tests were conducted on various grains, vegetables, milk, and meat obtained from endemic regions. The tests did not reveal much other than that the calcium content in potatoes and meat was relatively low (average of 0.005 percent for potatoes and 0.004 percent for meat). Similar data on potatoes and meat obtained around Moscow indicated 0.006 percent and 0.022 percent respectively. It was determined that the inhabitants in the area under survey lived on a diet which included more phosphorus than calcium. The investigators attempted to attach some significance to this fact but were puzzled for some time. They finally arrived at the following solution: apparently it is customary in this region to use foods which had a higher phosphorus content. Some decrease in the incidences was noted after calcium was added to the drinking water, but this only served to strengthen the theory that calcium deficiency was the primary cause of the disease, in view of the fact that the water originally contained little, if any, calcium.

Vinogradov, in his article, suggests the possibility that organic substances might have some bearing on the morbidity rate. Some work along this line was done by B. A. Skopintsev, who published the results of his research in an article (4) describing methods for determining the presence of organic substances in natural-water reservoirs. In general, there are two methods utilized for such analyses: (a) determining the losses on calcination, and (b) indirect methods (chemical, physical, and physicochemical, biochemical, and biological methods).

It has been determined that results obtained by the first method proved more often erroneous than not, while results obtained by the second series of methods proved more accurate. The most accurate among the second series of methods was the elementary analysis for the determination of the percentage content of various elements and chemical substances. It was determined that relative albuminoid nitrogen content and total organic nitrogen content is governed by the nature of the organic matter. Thus, for example, in waters which contain fresh undecomposed organic substances the ratio of albuminoid to total organic nitrogen is about 0:50, while in waters which contain primarily humuslike substances, the ratio is about 1:0. Results of other test methods are given rather comprehensively. Biological and biochemical tests showed that the number of bacteria in natural water reservoirs depended on the content of organic matter. The author believes that more study should be conducted on the possible relation between the existence of certain bacteria and specific organic substances in water.

V. V. Danilova (5) describes studies of the geochemistry of fluorine. Studies were conducted on various types of rocks which were representatives of three classes: (a) large crystallic rocks, (b) rocks of volcanic origin, and (c) rocks of sedimentary origin. Danilova was able to determine that in the case of large crystallic rocks the fluoring content was higher in acid rocks (3.5×10^{-2} percent F) than in basic rocks (2.85×10^{-2} percent F). On the other hand, the fluoring content of basic rocks of volcanic origin was higher (4×10^{-2} percent F) than in acid rocks of the same origin (1.26×10^{-2} percent F). In the sedimentary rock class she determined that dolomites and clay rocks had the highest fluorine content (2.39×10^{-2} percent while it was relatively low in gypsum and anhydrides (1.33×10^{-2} percent).

M. P. Belaya and N. V. Tageyeva (6) were coauthors of an article in which they attempt to determine the elementary chemical composition of pure strain wheat. Although some studies have been conducted to determine the effect of the mineral content of the soil on the mineral content of plants growing in the soil, the authors report that this is one of the First Soviet monographs on the subject of the elementary chemical composition of plants independent of their geographical location and the soil in which they are growing.

The authors chose pure strains of wheat for the purpose of determining basic chemical composition and incidentally to establish a grange of variation, if any, in the elementary chemical composition in relation to the mode of cultivation. The scientists found that generally the chemical composition did not vary much from plant to plant and there was no way of determining wheth er or not certain seeds came from specific plants (on the basis of chemical analyses). However, noticeable variations were obtained when the same pure strain was planted at different times during the year. The greatest variation was noticed in the case of the Hordeiforme strain, specifically with respect to silicon, iron, and manganese.

SOURCES

1. A. P. Vinogradov, "O Prichinakh Proiskhozhdeniya Urovskoy Endemii -- Geokhimicheskiye Issledovaniya" (Causes of Urcyskaya Endemia -- Geochemical Studies), Trudy Biogeokhimicheskoy Laboratorii, Vol IX, 1949.

2. P. N. Paley, "O Soder anii Kal'tsiya v Pit'yevykh Vodakh Rayona Urovskaya Endemii" (Calcium Content in Drinking Water in Regions where Urovskay Endemia Prevails), ibid.

3. V. S. Malinina, "Nextoryye Dannyye O Sostave Pishchevykh Produktov v Rayone Rasprostraneniya Urovskaya Endemii (Data on the Chemical Content of Foodstuffs in Regions Where Urovskaya Endemia Prevails), ibid.

4. B. A. Skopintsev, "Metody Opredeleniya Organicheskogo Veshchestva v Prirodnykh Vodakh -- Otsenka i Sopostavleniye" (Methods for Determining Organic Substances in Natural Waters - Evaluation and Description of Tests), ibid.

5. V. V. Danilova, "K. Soderzhaniyu Ftora v Porodakh" (Fluorine Content in Rocks), ibid.

6. M. P. Belaya and N. V. Tageyeva, "Khimicheskom Elementarnom Sostave Pshenits histykh Liniy" (Fundamental Chemical Composition of Pure Strain Wheat), ibid.

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